THE NAVY AERONAUTICAL LOGISTICS SYSTEM

by

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Prepared for

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PREFACE

Like poor Alice in Through the Looking Glass, the present-day student of the military profession is often likely to find himself having to run frantically to keep in the same place. This study, a case in point for the author, reviews recent development of the Navy's Aeronautical Logistics System in an attempt to "catch up" in this field after an absence of several years.

As will be evident from the text, the system in question is not defined by any single document nor even any single series of documents, so that assembling an overall picture of the system from the jig-saw puzzle of basic directives constituted the greatest single problem of the study.

In gathering material for this paper, assistance was obtained from many people in the Bureau of Aeronautics and the Bureau of Supplies and Accounts. While it is not possible to acknowledge all such assistance individually, the contributions of Commander W. B. Kirkland, USN, Management Engineering Officer, Management Services Office, Buaer, and Mr. G. A. Ryan, Procedures and Review Branch, Supply Division, Buaer, were particularly helpful.

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INTRODUCTION

Some historical perspective is prerequisite to appreciation of any form of human collective effort. In a current military study, such perspective is both particularly necessary and particularly difficult to achieve. The reason is simple. Men must interpret by the light of their experience. The experience of the military student of today differs so radically in scope from that of his counterpart in any and perhaps all former generations that bridging the mental gap between Past and Present has become all but impossible.

Weapon development rates of the last twenty years have exceeded those of previous periods to such an extent that the modern military student looking at the Past is placed in the figurtive position of attempting visualization of a zephyr at the height of the typhoon season. This parallel, though seemingly extreme, is not unsupported by historic fact. As illustration, consider the genesis of the five basic weapon types which antedate this century. These were the axe, the spear, the sword, the bow, and the gun. The axe is a product of the Lower Paleolithic Age sometimes before 250,000 B. C.[1,2]

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[1]Kenneth P. Oakley, Man the Tool Maker (3rd ed., London: Jarrold and Sons Ltd., 1956), p. 13.

[2]Ashley Montagu, Man: His First Million Years (New York: The New American Library, 1957), p. 58.

The spear and sword first appeared in the Middle Paleolithic before 25,000 B. C.[3,4] The bow came into use about 13,500 B. C. in the Upper Paleolithic.[5] At this point in the Old Stone Age, man vein of basic weapons ran out for the incredible span of 15,000 years, not to reappear again until the invention of the gun early in the thirteenth century A. D. Thus, from earliest times until Feudalism's close at Agincourt in 1415, all the numberless battles of human history were fought with Ice Age weapons systems. Though milleniums of "R & D" had changed some of the materials, the form and function was unaltered. Even after the invention of the gun, several centuries elapsed before the old standbys were fully displaced.

In painful contrast to the snail pace of past weapons evolution, the racing technology of the Twentieth Century has produced veritable weapons revolutions, dragging us from the gun, past the airplane, past the fission bomb, to the rocket borne fusion bomb in a few short decades. As a result, instead of being allowed centuries to digest each new weapons development, the reeling military have, since World War II, lived a nightmare in which revolutionary new weapons come faster than promotions.

Understandably, assimilation of this weapons avalanche has been fragmentary at best. This fact is nowhere more

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[3] Ibid., p. 52.

[4] Oakley, op. cit., p. 14.

[5] Ibid., p. 67.

evident than in the logistics field where valiant efforts are being made to support weapons of ever-increasing complexity within a seemingly ever-decreasing time frame.

To quote the Secretary of the Navy,

> The Navy is presently going through the most tremendous change it has ever undergone. It is passing from steam to nuclear power, from gunpowder to guided missiles, and in the air from propellor-type planes to supersonic planes, all at the same time.[6]

I believe that very strong emphasis should be placed on the final phrase, "all at the same time."

Since covering more than a small portion of this ferment in detail is manifestly impossible, a review of late developments in the Navy's Aeronautical Logistics System has been selected as illustrative of the situation in the military logistics field as a whole.

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[6]John C. Lackas and Elmore W. Seeds, Emergency Management of the National Economy, Vol. XIV: Military Supply Management (Washington, D. C. : Industrial College of the Armed Forces, 1957), p. 76.

CHAPTER I

THE NAVY'S LOGISTIC ORGANIZATION

Principal Parts.--Under the National Security Act of 1947, as amended, the Department of the Navy is one of three military departments within the Department of Defense. The Department of the Navy is administered by the Secretary of the Navy, subject to the control of the Secretary of Defense, and consists of three principal parts, namely:

1. The Navy Department, which is the central executive authority of the Naval Establishment located at the seat of the Government, and which comprises the bureaus, boards, and offices of the Navy Department; the Headquarters, United States Marine Corps; and the Headquarters, United States Coast Guard (when assigned to the Navy).

2. The Operating Forces of the Navy, which comprise the several fleets, seagoing forces, sea frontier forces, district forces, Fleet Marine Forces, the Military Sea Transport Service, and such shore activities of the Navy and other forces and activities as may be assigned to the Operating Forces of the Navy by the President or the Secretary of the Navy.

3. The Shore Establishment, which comprises all activities of the Naval Establishment not assigned to the Operating Forces of the Navy and not a part of the Navy Department. This includes those operating forces of the Marine Corps which are not assigned to the Operating Forces of the Navy or to a unified or joint command.[7]

Top Executive Organization.--In addition to the Secretary, the Navy's top executive organization includes two

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[7] Ibid., pp. 51-52.

groups: (a) the Civilian Executive Assistants and (b) the Naval Professional Assistants. The Civilian Executive Assistants are:

1. The Undersecretary of the Navy.

2. The various Assistant Secretaries of the Navy.

The Naval Professional Assistants are:

1. The Chief of Naval Operations, who is the principal Naval Professional Assistant and the Naval Command Assistant.

2. The Commandant of the Marine Corps, who is the Marine Corps Command Assistant.

3. The Commandant of the Coast Guard when the Coast Guard is operating as a part of the Navy.

4. The Naval Technical Assistants, who are the chiefs of bureaus, the Chief of Naval Research, the Chief of Naval Materiel, and the Judge Advocate General.

Top Executive Responsibilities.--The broad responsibilities of the Department of the Navy are defined by the policy statement of General Order No. 5 of 20 November 1954 as follows:

> To maintain the Department of the Navy as a thoroughly integrated entity with sufficient strength on the sea and in the air to uphold, in conjunction with our other Armed Forces, our national policies and interests, to support our commerce and our international obligations, and to guard the United States including its overseas possessions and dependencies.

This statement of policy has been interpreted as imposing upon the Navy four principal tasks, "policy control," "naval command," "logistic administration and control," and "business administration." Of these "logistics administration

and control" is of primary interest in this study, though "business administration" is, of course, involved to some extent.

Responsibilities for Logistic Administration and Control.--"Logistic administration and control" is the task of coordinating and directing the effort of the Navy Department and the Shore Establishment in order to assure the development, procurement, production and distribution of material, facilities, and personnel to the Operating Forces. The task also includes the important elements of planning and forecasting requirements."[8]

Responsibility has been assigned to the Chief of Naval Operations for the portion of this task which embraces:

1. Planning, forecasting, and determining the requirements of the Operating Forces of the Navy for equipment, material, personnel, and supporting services, and for coordinating the efforts of the bureaus and offices of the Navy in support of these requirements.

2. Issuing statements of requirements of the Operating Forces of the Navy, and reviewing the progress of the bureaus and offices of the Navy in fulfilling these requirements.

3. Collaborating with the Civilian Executive Assistants in fulfilling the requirements of the Operating Forces of the Navy.

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[8]"How the Department of the Navy is Organized," Armed Forces Management, November 1957, p. 17.

4. As naval executive, coordinating and integrating the requirements of the Operating Forces of the Navy, of the Marine Corps, and of the bureaus and offices of the Navy Department into total requirements of the Department.

Responsibilities, as above, for matters of Marine Corps interest in this area are assigned to the Commandant of the Marine Corps.

The portions of the task of logistics administration and control not assigned to the military chiefs are combined with the business administration task and divided among the Civilian Executive Assistant under the supervision of the Under Secretary of the Navy.

To summarize the responsibilities and tasks involved in this study at the executive level, the Secretary exercises policy control over the Department of the Navy. The Chief of Naval Operations, the Commandant of the Marine Corps, and the Civilian Executive Assistants share responsibilities for the task of logistic administration and control. The chiefs of the offices and bureaus of the Navy are charged with logistic support of the Operating Forces according to requirements established by the Chief of Naval Operations and the Commandant of the Marine Corps.[9]

Basic Support Functions and Major Logistic Systems.--As is readily apparent from the Navy's bureau structure, support functions are divided into five basic programs, personnel,

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[9] *Ibid.*, pp. 17-18.

ships, aircraft, ordnance, and bases. The activities of the Shore Establishment function as direct bureau agents in support of the Operating Forces. With respect to material, the five basic support programs are at present sub-divided into thirteen major sub-programs or systems.[10] Each of these systems involves a single category of specialized material and comprises the following elements:

1. The parent technical bureau for the material in question.

2. The Bureau of Supplies and Accounts.

3. An inventory control center usually called a "Supply Demand Control Point."

4. The other activities of the Shore Establishment and Mobile Support Forces which service, store, procure, and distribute this class of material.

5. The Operating Forces which consume this class of material.

Inventory Control Centers.--Most of the system elements listed above are familiar organizational groups. However, the Navy inventory-control centers or Supply Demand Control Point are to a degree unique and deserve some further explanation.

The Navy SDCP not only controls the specialized inventory for which it is responsible, but also attempts to

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[10] U. S. Navy Department, Bureau of Supplies and Accounts, The Navy Stock Fund--Annual Report Fiscal Year 1958, NAVSANDA Publication 263, p. 3.

achieve a dynamic balance between supply and demand for items in its assigned material area. Thus, the major functions of the SDCP are the determination of requirements in an assigned area, the procurement of requirements, and the distribution of these requirements to meet demand. The dual technical and supply aspects of these functions result in dual control of the SDCP's. Jurisdiction in technical matters is assigned to the parent technical bureau. Jurisdiction in supply matters is assigned to the Bureau of Supplies and Accounts. Management control of the SDCP's, including operating, staffing, and equipping is also assigned to BuSandA. The inventory controlled by an SDCP consists of consumables and new or overhauled repair parts in support of one of the five basic programs. This inventory may be located physically at any or all Navy supply activities throughout the world, both ashore and afloat. For certain major end items in each program, the parent technical bureau maintains direct control, acting in effect as SDCP for this material.

In terms of value, as of 30 June 1958, the SDCP's controlled material worth \$5.1 billion or 44 percent of the Navy's total operating inventory. On this same date, the bureaus controlled directly material worth \$6.5 billion or 56 percent of the Navy's total operating inventory.[11] These figures seem, at first glance, to show that the bureaus not

[11] U. S. Navy Department, Bureau of Supplies and Accounts, BuSandA Statistical Review--Fiscal Year 1958, NAVSANDA Publication 291, p. 3.

the SDCP's are the major inventory managers in the logistic programs. Actually, while the bureaus control a substantial majority of the operating inventory on a dollar basis, they control only a small percentage of the total inventory on an item basis. For example, on 31 December 1956 though the bureaus controlled inventory valued at $8.2 billion, the number of items involved was only slightly over 40,000 including mobilization reserve ammunition worth over $3 billion. On this same date though the SDCP controlled inventory was worth only $5.5 billion, the number of items involved was over 1,200,000.[12] Thus, not only are bureau-controlled items relatively few in number, but also many are of types not ordinarily involved in day-to-day transactions. In addition, it should be noted that bureau-controlled items are actually handled, shipped, and stored by the regular supply system.

The Distributive System.--The activities of the supply system which actually store, handle, and issue material comprise the so-called "Distributive System." This system includes supply-managed activities such as supply depots and centers and the supply departments of certain shore establishments such as shipyards and air stations. The four echelons of the distributive system are:

1. Distribution Points. Reporting activities which carry stock for the supply support of designated continental and extracontinental primary stock points. Replenishment is

[12] Lackas and Seeds, op. cit., p. 63.

usually direct from sources external to the system.

2. Primary Stock Points. Reporting activities which carry stock for their own consumption, for designated continental or extracontinental secondary stock points and may also support fleet units and yards and district craft. Replenishment may be from Distribution Points or from external sources.

3. Secondary Stock Points. Carry stock for their own consumption and for the support of assigned yard and district craft and aircraft. Replenishment is normally from higher echelons of the Distributive System.

4. Reserve Stock Points. Carry reserve and bulk stock for the supply system.

In addition to the above-listed echelons, the Distributive System includes Fleet Issue Ships.[13]

Mobile Logistic Support.--Modern developments in warfare have increased the importance of the traditional mobility of the Navy. The concept of "mobile logistics support" grew out of the requirements that first arose in World War II for sustained fleet supply on a world-wide basis. To meet these requirements it was necessary first to improvise floating supply depots and shipyards and later to organize regular "service squadrons."

The mobile logistics support forces usually consist of three different groups of ships, the underway replenishment group, the mobile support group, and the "pipeline vessels."

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[13] The Navy Stock Fund, op. cit., pp. 4-5.

The underway replenishment group is specially trained and equipped for actual transfer-at-sea procedures. The mobile support group backs up the underway supply group and provides direct support to fleet units in harbor. The pipeline vessels replenish the vessels of the other two groups.[14]

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[14] Lackas and Seeds, op. cit., pp. 73-74.

CHAPTER II

THE NAVY AERONAUTICAL LOGISTICS SYSTEM

Scope of the System

The Aeronautical Logistics System is the largest and most complex of the Navy logistic systems; as indicated by Figure 1, a comparison of the number of standard stock items handled by the various systems. The problems of the system are numerous and to a certain extent unique due to a combination of the following factors:

1. Complexity of equipment.
2. High cost of equipment.
3. Rapid obsolescence.
4. High reliability requirements.
5. High mobility of the consumer.

These factors are, of course, magnified at present by the Navy's world-wide commitments in a time of continuing international tensions.

Some idea of the scope of the system may be gained from the following "balance sheet" enumeration of the assets involved. The fixed assets of associated supply activities are excluded from this tabulation to eliminate the problem of allocation, since many supply depots serve more than one logistic system.

Fig. 1.--Navy Standard Stock Items by Material Cognizance

The aeronautical system supports the fleet through 214 separate shore activities located at 86 stations under the management control of Buaer. Many of these stations are overseas. Six hundred fleet maintenance activities are also included in the system. A total of 144,000 people, including 64,000 civilians man this network. The assets of the system are valued at over 12 billion dollars divided as follows:

TABLE 1

ASSETS OF THE NAVY AERONAUTICAL LOGISTICS SYSTEM

Assets	Value	Navy Total
Aircraft	$5 Billion	-
Plant Property	$3 Billion	30%
Aeronautical Support Material	$4 Billion	30%
Total Assets	$12 Billion	

The above totals include $200 million in tools and equipment at the eight major aircraft overhaul centers and over $600 million in tools and equipment at 115 lesser overhaul points.

Annual expenditures for the system are running at about $1.36 billion or 12% of the total for the current Navy budget.[15] It is interesting to note that despite the size of this support system one quarter of the Navy's aircraft overhaul and repair work has been done by private concerns for the past

[15] R. M. Reynolds, RADM, USN, and W. B. Kirkland, CDR, USN, "The Naval Air Material Support Program," Presentation to Hon. C. P. Milne, Asst. Sec Nav (Material), Buaer, Washington, D. C., April 24, 1959.

three years. The Chief of Buaer, Rear Admiral R. E. Dixon, recently stated that such outside work will be increased to one-third of the total in 1960.[16]

Elements of the System

The parent technical bureau, the Bureau of Aeronautics,

> is responsible for the design, development, procurement, production, test, fitting-out, maintenance, alteration, repair, and material effectiveness of Navy and Marine Corps aircraft, target drones, and certain guided missiles, including components and equipment thereof, landing and arresting equipment and photographic and aerological equipment; the research therein; and all pertinent functions relating thereto. It contracts for naval aircraft and aviation equipment of a technical specialized nature; and provides plant facilities and schedules as necessary for the production of these items.[17]

In terms more specific to the Aeronautical Logistics System, the Bureau of Aeronautics furnishes technical guidance to the SDCP, procures and controls major end items of the system inventory, such as aircraft and aircraft engines. Buaer also has management control of the activities of the Shore Establishment which support aircraft.

For this system, as for all Navy logistics systems, the Bureau of Supplies and Accounts is the parent bureau in supply matters. These matters include management control of the Aviation Supply Office and material support of the aviation activities of the Shore Establishment through all or most of twenty continental and five overseas supply deports or

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[16] "Washington Air Letter," Aeronautical Procurement, November 1958, p. 14.

[17] U. S. Navy Department, Bureau of Aeronautics, Bureau of Aeronautics Organization Manual, Buaer 5430.1A dated 1 February 1956, p. vii.

centers.[18]

The Aviation Supply Office, SDCP for the Aeronautical Logistics System, had its origins in World War II. Soon after Pearl Harbor mounting demand for many types of new and specialized equipment began to overtax the already sorely-tried channels of the regular supply system. As a result, new, "private" channels developed more or less directly from the technical bureaus to the fleet. By the end of the war, approximately thirty-two specialized supply offices were operating in addition to the regular supply activities.[19] The largest and most active of these semi-independent channels was the Aviation Supply Office of the Bureau of Aeronautics.

The "Integrated" Supply System

Post-war studies of the Navy's war-tangled supply situation showed clearly that major revisions were required. These revisions took form in the new "integrated" supply system as described below:

> The "integrated" Navy Supply System was approved by Secretary of Navy Forrestal on 14 February 1947 to eliminate the defects that had developed in the Navy's logistic support system during and after World War II. The new system clearly differentiated between the technical and supply functions. It emphasized that the performance of the technical functions was a responsibility of the designated technical bureau. The plan was based on recognition that the performance of the supply functions is essentially the same regardless of the particular material area being considered, and consequently management of the supply tasks is best accomplished by one agency or bureau.

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[18] Armed Forces Management, p. 45.

[19] Ibid., p. 28.

The new Navy Supply System provided that the control of major end items of equipments--these being the expensive, infrequently issued, individually handled items--would remain in the hands of the cognizant technical bureaus. It provided that control of the smaller assemblies, repair parts, and consumables would be vested in an office which would control one broad category of the Navy's inventory. This office would act as an inventory-control point. The new system effected a "marriage" of the technical and supply functions at the inventory-control point. The inventory-control point was directed to look to the parent technical bureau for guidance in technical matters pertaining to the particular material area, and to the Bureau of Supplies and Accounts for guidance relating to the performance of its supply functions. It is in this latter sense that the new Navy Supply System is again "integrated" in that all of the inventory control points in all material areas are managed by and receive their guidance and direction from one bureau, the Bureau of Supplies and Accounts, the "business" bureau of the Navy.[20]

Under the new system, the hitherto semi-independent ASO was "integrated" as the SDCP for the Aeronautical Logistics System though Buaer retained management control until early 1959.

The System Inventory

The system inventory consists of new and overhauled items in each of three major categories or sub-inventories:

1. The aircraft inventory.
2. The engine inventory.
3. The equipment inventory.

The Bureau of Aeronautics acts as inventory manager for the aircraft and engine inventories and certain specialized items of the equipment inventory. The ASO manages the remainder of

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[20] Lackas and Seeds, op. cit., pp. 60-61.

the equipment inventory. As previously noted, though Buaer appears to be the primary manager in the foregoing description, actually the bulk of the items are handled by ASO with only a relatively few high-cost items being reserved to the bureau. This point is clearly demonstrated in the following table.

TABLE 2

THE AERONAUTICAL LOGISTICS SYSTEM INVENTORY, 30 JUNE 1958

Inventory Classification	Number of Items	Approx. Total Cost	Approx. Average Cost/Item(A)	Ratio A_x/A_{Equipt}
Aircraft	10,800	$5 billion	$465,000	120
Engines	20,000	$1.6 billion	$ 80,000	20
Equipment	475,000	$2.33 billion	$ 3,900	1

The ratio of cost per item of bureau-controlled to ASO-controlled material is actually even higher than indicated by Table 2, since in the equipment inventory the average number of units per item is much greater than one, whereas each "item" of the other inventories consists of a single aircraft or engine.

As of 30 June 1958, the ASO standard stock inventory, which included 5000 photographic items in the 475,000 total, represented 40% of the SDCP-controlled standard stock items for the entire Navy. The next largest SDCP, the Electronic Supply Office, stocked "only" 181,000 items at this time.[21]

[21] BuSandA Statistical Review--Fiscal Year 1958, p. 22.

Actual sales from the ASO inventory for fiscal year 1958 amounted to 567 million dollars or 88% of the 645 million dollar total planned for this period.[22]

Operation of the System

As was pointed out earlier, five main elements are involved in operation of the Aeronautical Logistics System. These elements singly and in various combinations accomplish the support objectives of the system through the following principal processes:

1. Determination of material requirements.
2. Procurement of material.
3. Distribution of material.
4. Budgeting for future procurement.
5. Overhaul of reusable material.
6. Elimination of excess or unusuable material.

Since space and time limitations preclude detailed study of more than a few aspects of these processes, attention will be directed to the two areas presently of greatest concern to the parent bureaus, namely:

1. Inventory management.
2. Overhaul workload control.[23]

Inventory Management

The Aircraft Inventory. At the close of fiscal year

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[22] *Ibid.*, p. 12.

[23] U. S. Navy Department, Bureau of Aeronautics, Joint Buaer/BuSandA Program for Refined Aeronautical Support Program--PROJECT RASP, Buaer Instruction NAVAER 00.108 dated 16 Feb 1959, p. 7.

1958 the Navy's aircraft inventory consisted of some 10,000 aircraft of which 7600 were in operating status, organized as follows:

Carrier Air Groups	16
Carrier ASW Squadrons	22
Patrol and Early Warning Squadrons	42
Marine Air Wings	3

At the present time twenty three models of naval aircraft are on order, including one blimp.[24] As an augury of the future it should be noted that thirteen models of guided missiles are also on order by the Navy at this time.[25]

Aircraft are assigned to the Operating Forces by Buaer in accordance with allowances established by CNO. Control of the aircraft inventory in the Operating Forces, the Pacific Fleet for example, is then assigned to the Type Commander, Commander Naval Air Force, Pacific Fleet in this instance. Sub-control is exercised by "Commander's, Fleet Air" located throughout the Pacific Ocean area. Due to the relatively small number of physical units involved and the fact that these units are usually self-transporting, problems of managing the aircraft inventory are not typical of the logistics system as a whole and, hence, will not be considered in detail.

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[24] Cecil Brownlow, "Navy Stresses Simplicity, Reliability to East Budget Pinch," Aviation Week, 26th Inventory of Air Power, March 9, 1959, p. 80.

[25] Ibid., p. 187.

The Engine Inventory. At the close of fiscal year 1958 the Navy's aircraft engine inventory included some 20,000 units of three distinct types, reciprocating engines, turbo-propellor engines, and jet engines. Thirty-two basic models were in use.[26]

The engine inventory is controlled on what is described as a "two echelon" basis. Actually, control is on a three echelon basis with Buaer acting both as the top, coordinating echelon and as a member of the next echelon which also includes the major air commands. Members of this echelon are designated as "Controlling Custodians of Engines." The lower echelon consists of physical custodians of engines, such as squadrons, air stations, aviation vessels, supply centers, etc. Members of this echelon are designated as "Reporting Custodians of Engines."[27] Reporting custodians are assigned on an organizational basis to a controlling custodian. An aircraft carrier of the Pacific Fleet, for example, reports to ComNavAirPac as controlling custodian. Aircraft manufacturers, test stations, etc. report directly to Buaer. Controlling custodians in turn make up composite reports on their units for submission to Buaer.

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[26] U. S. Navy Department, Bureau of Aeronautics, Manufacturing Cognizance of Designated Models of Aircraft Engines and Related Aeronautical Material; Establishment of, Buaer Instructions NAVAER 00.93 dated 3 Oct 1957, Encl. 2, p. 1.

[27] U. S. Navy Department, Bureau of Aeronautics, Aircraft Engine Accounting System, Buaer Instruction NAVAER 02.7A dated 21 Nov 1957, Encl. 1, p. 1.

This accounting system

> requires the submission of the aircraft engine accountability report which includes inventories, performance, and status. . . . and explains procedures to be followed to ensure the collection of data necessary to establish the engine failure rate and engine life expectancy by actuarial methods.[28]

For reporting purposes, engines are divided into installed and uninstalled categories. Monthly reports are required on every installed engine of modern type. On forty-four obsolescent engine models, reports are required only when a status change occurs. Monthly reports are required from custodians on every uninstalled engine which was received during the month or which underwent a change of status during the month. Controlling Custodians verify their inventory at least quarterly by having his Reporting Custodian physically check and verify local inventories. Buaer requires over-all inventory verification twice yearly on 30 June and 31 December. The first inventory under the present system was made on 31 December 1955.[29]

Three reporting devices are used:

1. (NAVAER 5058) "Monthly Aircraft Engine Accountability Report"--a printed form listing groups of engines reported by a single custodian. Discussed in detail below.

2. (NAVAER 5106)--a prepunched IBM card form with space for certain written entries. Prepared by controlling custodians for use by reporting custodians. Applies to

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[28] Ibid., p. 1.

[29] Ibid., pp. 2-3.

individual engines and is equivalent to a single line entry on NAVAER 5058 above.

3. IBM Cards--No space for written entries. Otherwise similar to NAVAER 5106 above. Prepared in lieu of entries on NAVAER 5058 by eight reporting custodians, major air stations, having suitable equipment.[30]

NAVAER 5058, the Monthly Aircraft Engine Accountability Report shown in Figure 2 is much more than a simple condition and location report. Numerical codes are used to permit quite a comprehensive statement of engine history to be condensed into the single line twelve column entry allowed her engine. The purpose of each of the twelve columns is given in the column headings on Figure 2 . Two codes are used, a "removal code," and a "status code." The removal code consisting simply of the numbers 1 through 4 classifies engine removal as due to:

1. Damage
2. Reached full time
3. Failed
4. Repairs.

The Status code, also numerical, is more elaborate. Installed engines may be assigned any one of three "beginning of the month" codes and any one of three "end of the month" codes. They may also be assigned any one of three "beginning or end of the month" codes. Serviceable engines, i.e. engines not installed but in usable condition, can fall into any one of ten categories for which a code is assigned. Unserviceable

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[30] *Ibid.*, Encl. 1, p. 1.

ENCL.(1)

MONTHLY AIRCRAFT ENGINE ACCOUNTABILITY REPORT
NAVAER - 5058

Refer to latest issue of BUAER INST NAVAER 02 7

Submit original to controlling custodian

1. REPORTING ACTIVITY	4. COMMAND	5. SIGNATURE	6. REPORTING MONTH
VF-68	COMAIRPAC	John W. Doe	April 1957
2. LOCATION: NAS NORIS; 3. ACCT'G. NO.: 002345			7. DATE OF REPORT: 6 May 1957

	ENGINE MODEL AND DASH NO. Type	Model	Mfg	Dash No.	Mfg	ENGINE SERIAL NUMBER (B)	AIRCRAFT MODEL (C)	STATUS CHANGE DATE (D)	REC'D FROM/SHIPPED TO (Activity) (E)	B.O.M. HOURS SINCE O.H. (F)	B.O.M. STATUS CODE (G)	E.O.M. HOURS SINCE O.H. (H)	E.O.M. STATUS CODE (I)	REMOVAL CODE (J)	HOURS SINCE NEW (K)	NUMBER OF OVERHAULS (L)
1.	J	65	W	4B	W	610128	FJ3			101	13	135	14		135	
2.	J	65	W	4B	W	610149	FJ3	20		141	13	159	31	3	159	
3.	J	65	W	4B	W	610265	FJ3	5		85	16					
	J	65	W	4B	W	610265	FJ3	31				96	31	1	96	
4.	J	65	W	4B	W	610296	FJ3	15		5	16	19	14		198	1
5.	J	65	W	4B	W	610306	FJ3	8	FASRON 4	126	15					
	J	65	W	4B	W	610306	FJ3	18		132	26			4		
	J	65	W	4B	W	610306		21		132	27					
	J	65	W	4B	W	610306	FJ3	25		132	16	138	14		208	1
6.	J	65	W	4B	W	610401	FJ3	23	BAR Columbus	136	11	137	12		137	
7.	J	65	W	16A	W	612401	FJ3	29		312	13	344	31	2	344	
8.	J	65	W	16A	W	612429	FJ3	12		106	13	112	31	2	241	1
9.	J	65	W	16A	W	612532	FJ3	8	BAR Columbus	122	15					
	J	65	W													
	J	65	W												134	

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Fig. 2.--The Monthly Aircraft Engine Accountability Report (NAVAER 5058)

GOVERNMENT PRINTING OFFICE

engines can also be assigned any one of ten codes. Non-repairable engines have eight code categories and three special codes also exist.[31]

The engine accounting reports reaching Buaer either via the Controlling Custodians or direct from certain Reporting Custodians are converted to punch card format, if not already in that form. By means of an IBM-650 Computer and an IBM-407 Accounting Machine, this data is processed for purposes of a) inventory control, b) actuarial prediction, c) pipeline analysis. Figure 3 is a diagram of the flow process for engine report analysis in Buaer. It will be noted that among the outputs of this analysis system are a) spare engine requirements, b) overhaul scheduling requirements, c) engine removal predictions, d) inventory stratification by age since overhaul, and e) engine failure rates.[32] These data are used by Buaer for inventory redistribution, procurement, budgeting, etc.

<u>The Equipment Inventory</u>. At the close of fiscal year 1958, the Navy's aeronautical equipment inventory numbered 475,000 standard stock items under ASO control valued at about $2.3 billion dollars. In addition, Buaer controlled a limited number of infrequently issued, high cost equipment items, designated as "V" cognizance material.

Management of the equipment inventory is based on two

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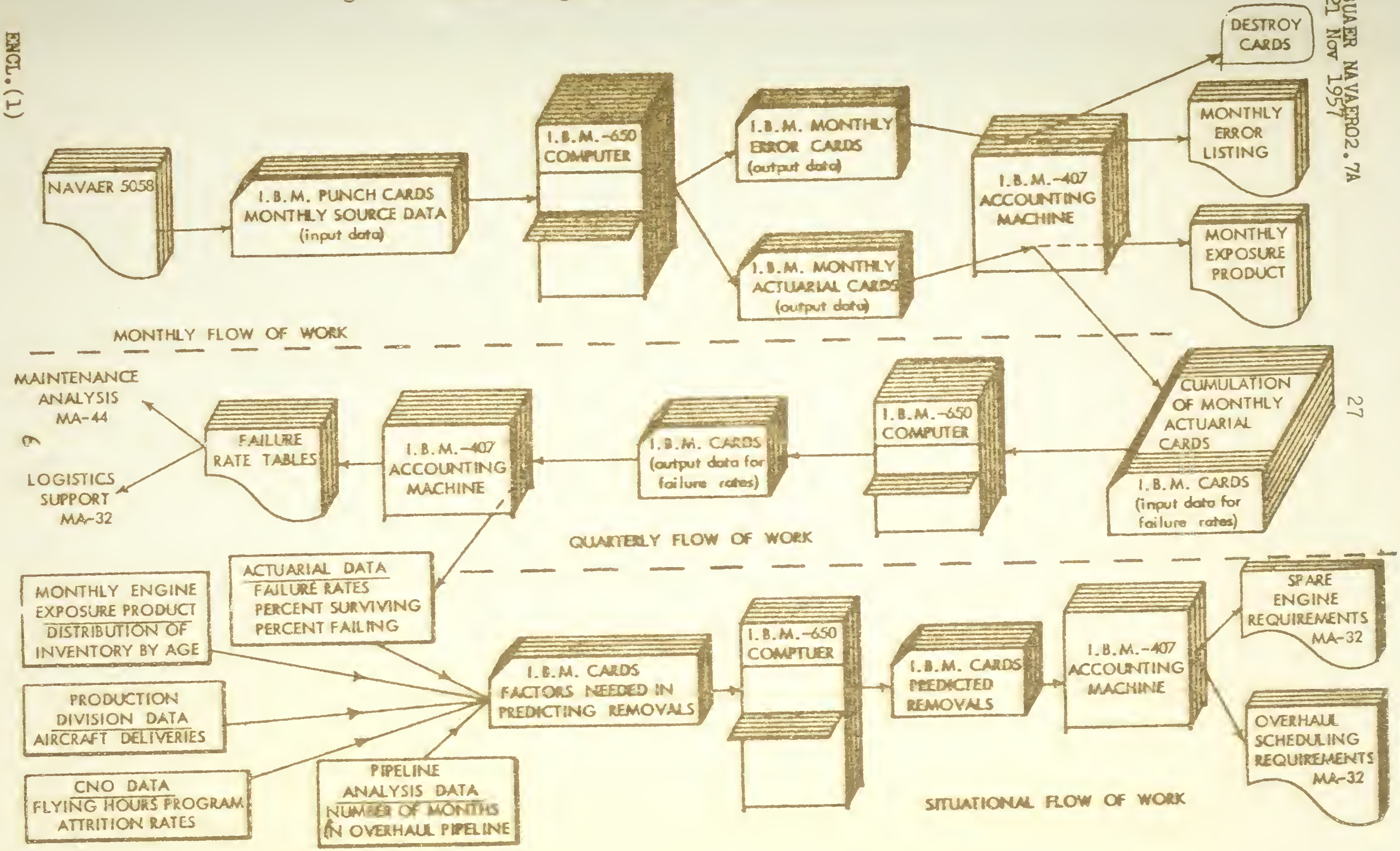
[31] <u>Ibid</u>., Encl. 1, pp. 8-21.

[32] <u>Ibid</u>., Encl. 1, p. 6.

Fig. 3.--Flow Diagram for Engine Report Analysis



complementary systems, the Program Usage Replenishment System known as "PURS" and the Replenishment Demand Issue System known as "RDIS".

The PURS system, which covers most of the main items of aeronautical equipment, is a mechanized system that estimates requirements on the basis of past usage and provides or "pushes" replenishment material out to field activities automatically on the basis of these estimates. The RDIS system which covers only minor items of general aeronautical material not covered by the PURS system, provides replenishment to activities on the basis of actual issues rather than for estimated requirements.

The following description is based on a presentation by Mr. G. A. Ryan, Assistant Head, Procedures and Review Branch, Supply Division, Buaer. The PURS system is predicated on the simple assumption that material requirements for aircraft spares are related to the operations of the aircraft. The principle of management by exception is used throughout. For a given case, the following information is required:

1. Equipment application.
2. Repairability.
3. Past usage by aircraft model.
4. Aircraft operation, hours.
5. Number of previous overhauls.
6. Location of future operations.
7. The inventory, ready for issue and awaiting repair.

This information is obtained in punch card format as part of

the regular aeronautical logistics system reporting processes. Computer techniques are used by ASO to obtain:

1. Procurement and disposal lists.

2. Budget requirements.

3. Overhaul requirements.

4. Redistribution schedules.

Programs are calculated in terms of Maintenance Cycles and Overhauls. A Maintenance Cycle is defined as 240 hours of operation of an aircraft, reciprocating engine, or related assembly. For a jet engine or related assembly the corresponding time is 60 hours.

To calculate Maintenance Cycle Programs historical data on past maintenance cycles is combined with maintenance cycle predictions, operational data by aircraft model per month, and future deployment plans to compute:

1. The operating plane months at each activity for each aircraft.

2. The number of hours each model aircraft will operate at each activity.

3. The maintenance cycles by each activity for each aircraft, engine, equipment.

To illustrate, consider the following simplified example:

If: A = The operating hours of the J34 engine at Alameda in the next nine months.

B = The number of ignition units per J34 engine.

C = The prescribed number of hours between

maintenance cycles for jet engine accessories.

D = Predicted maintenance cycles for J34 ignition units at Alameda in the next nine months.

Then: $D = \frac{AB}{C}$

The point of departure for Program Overhaul calculations for equipment is the Buaer aircraft and engine overhaul schedule which covers a nine month period. From this schedule the overhauls to be received by equipment concurrently with aircraft or engines are computed. To this, the Buaer schedule of equipment overhauls is added. The result is a consolidated overhaul program showing:

1. Number of aircraft overhauls.
2. Number of engine overhauls.
3. Number of equipment overhauls.

Overhauls are broken down by station for distribution. For procurement purposes, however, they are lumped together.

The two preceding programs result, for each aircraft model and for each activity, in a tabulation of the following:

1. Number aircraft maintenance cycles.
2. Number engine maintenance cycles.
3. Number equipment maintenance cycles.
4. Number aircraft overhauls.
5. Number engine overhauls.
6. Number equipment overhauls.

Usage data are required in terms of percent replacement per maintenance cycle and per overhaul. These percentages are called the maintenance and overhaul replacement factors

respectively. Two elements are considered in usage, the number of times an item is actually used, and the number of times it might have been used. The opportunity for maintenance use arises during the maintenance cycle, for overhaul use during the overhaul cycle. Replacement factors are calculated from the usage elements by ASO as the following ratio:

$$100 \times \frac{\text{Number of Actual Uses per Item per Period}}{\text{Number of Maintenance Cycles per Item per Period}}$$

Maintenance replacement factors are based on usage reports from operating activities. Overhaul replacement factors are based on similar reports from overhaul and repair activities.

The "application" of an item of equipment to an aircraft or engine refers to which engine or aircraft model the item is used on and how many units of equipment are used per individual engine or aircraft. Application data are assembled by ASO into two technical files:

1. The Master Control File which contains data on all repairable assemblies.

2. The Engineering Data File which contains data on non-repairable parts, such as gaskets, required to maintain the assemblies of the master file.

Over twenty-five items of information, including stock number, unit price, etc. are recorded for each of the parts or assemblies listed in the technical files.

The information, operations and calculations previously described under the PURS system boil down finally to a single

number for each item representing the net requirement of the system for that item during the next nine month period. The "boiling" operation is best illustrated by use of a simplified example of a procurement calculation.

Let us start with a single item, a gasket. The inputs and operations of the PURS system provide the following facts about this gasket:

A.	Item	Gasket
B.	Application, Gasket	Fuel Pump
C.	Number of Gaskets per Pump	3
D.	Application, Pump	Aircraft Engine
E.	Number of Pumps per Engine	2
F.	Number of Engines per Aircraft	4
G.	Gasket Interchangeable	No
H.	Maintenance Replacement Factor	200%
I.	Overhaul Replacement Factor	100%
J.	Maintenance Cycles, Aircraft	20
K.	Maintenance Cycles, Engine	80
L.	Maintenance Cycles, Pump	160
M.	Overhaul Cycles, Engine	15
N.	Overhauls, Pump (Concurrent)	30
O.	Overhauls, Pump (Spares)	45
P.	Inventory of Gasket	900

Maintenance requirements for the gasket are obtained from the following equation:

L x C x H = Maintenance Requirements, Gasket

160 x 3 x 200% = 960 units

Overhaul requirements for the gasket are obtained from the following equation:

(N + O) H x I = Overhaul Requirements, Gasket.

(30+ 45) 3 x 100% = 225 units

Total requirements for the gasket equal the sum of the maintenance and overhaul requirements or in this case: 1185 units. Net requirements are obtained by subtracting the gasket inventory (P) from the total requirements. The result in this case is 1185 - 900 or 285 units, net procurement requirements of the system for "the" gasket. Similar calculations are performed on an item for each area of the system to determine redistribution requirements.

The control data assembled under the PURS system permits, not only requirement calculations for each item of inventory, but also calculation of:

1. An overhaul schedule for spares.
2. Military Defense Aid Program requirements.
3. The retention and disposal program.
4. Mobilization requirements.
5. Budget requirements.
6. Requirements for sudden changes in force deployment.
7. Outfitting requirements.

This data is also used in publishing parts catalogs and allowance lists.

To summarize, the PURS system computes gross requirements for each item of aeronautical equipment. These

requirements are used to develop:

1. Net requirements for procurement.
2. Requirements for spares overhaul (21 month cycle).
3. Redistribution requirements (9 month cycle).

Inventory data is obtained by activity as:

1. On hand--Ready for Issue.
2. On hand--Requiring Overhaul.
3. Due--On order.

This inventory data is applied against requirement calculations to determine:

1. How much to buy.
2. How much to overhaul.
3. How much to dispose of.
4. What activities need material.
5. What activities have excess material.

No detailed description of the RDIS System is considered necessary, since it simply involves periodic replenishment of stock on the basis of demand and issue at the activity in question.

<u>Stock Status Reporting</u>. Stock status reports must form the basis of any inventory control system. The requirements of such reports depend on the size, variety and distribution of the inventory in question and on the types of transactions involved, as well as on the extent of control desired. Virtually all these factors are maximized in complexity for the Navy's aeronautical equipment inventory. Two major and several auxiliary reporting systems are used by

ASO in managing this inventory. Details of both major systems will be discussed, and the most important auxiliary systems will be outlined. Stock status reporting for the engine inventory has already been covered in a previous section.

The Quarterly Stock Status Report. Routine stock status reports for most of the items of the equipment inventory are submitted via the "Quarterly Stock Status Report." Items under both the PURS and RDIS inventory management systems are so reported. In explaining this system to field activities, the Commanding Officer of ASO says:

> The importance of accurate and timely reporting in accordance with the current Quarterly Stock Status Report (QSSR) schedule cannot be overemphasized. To accomplish its assigned mission of Supply Management, involving proper procurement, redistribution, and disposal of material, ASO must receive accurate and timely reports from all reporting activities in order to prepare the Consolidated Stock Status Reports (CSSR's) which are the basis for all inventory control decisions.[33]

The point of departure for the system is the QSSR schedule originated by ASO and covering a fiscal year. This schedule breaks the items of the equipment inventory into groups or "ranges" with reporting dates established for one group each week. Tailored decks of EAM cards are furnished to each activity by ASO in advance of the group reporting date. Write-in cards are sent to non-mechanized activities. The reporting cycle is defined as the past three months. "Active"

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[33]U. S. Navy Department, Aviation Supply Office, Quarterly Stock Status Reporting (Active Item), ASO Field Instruction 4440.37A dated 15 Dec. 1958, p. 1.

item reporting is required. This means reporting only those items, within the range of items to be reported, which have changed in stock status during the reporting cycle.[34] At present, fifteen bits of status information are reported per item.

From the QSSR group reports, ASO compiles an RDIS material Consolidated Stock Status Report (CSSR) and a PURS material CSSR for items of the group. The RDIS material CSSR includes eleven bits of information per item.[35] The PURS material CSSR includes about twenty-eight bits of information per item, many of which are calculated by ASO for internal use only.[36] Consolidated lists broken down by area are sent to primary stock points with a deck of "Action Required Cards" about thirty days after the scheduled field reporting date for the group. Cards furnished at this time cover only items for which no area deficiency exists. Primary stock points then perform a "sub-SDCP" function by intra-area redistribution of these items. ASO retains for action cards on items in which

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[34] Ibid., p. 2.

[35] U. S. Navy Department, Aviation Supply Office, Processing of Replenishment Demand Issue System and Program Usage Replenishment System Consolidated Stock Status Reports and EAM Action Required Cards under the Active Item Reporting Program; Instructions Concerning, ASO Field Instruction 4440.29D dated 9 January 1958, Encl. 2, p. 1.

[36] Ibid., Encl. 3, p. 12.

area deficiencies exist. Action may consist of inter-area redistribution direct to primary and secondary stock points, intra-area supply direct from a processing point, or procurement.

The HI-PRI Plan. This plan is the major stock status reporting means by which ASO manages the non-routine items of the equipment inventory. The plan is outlined below:

> The Aviation Supply Office, in order to provide maximum logistic support to the Naval Aeronautical Organization, has developed a plan called HI-PRI. This plan is a specially tailored inventory management program for positive selection, control and more frequent inventory reporting of a select number of items which account for a large portion of the inventory investment. In the selection of the HI-PRI items repairability of an item is the primary and overriding criterion. The value of projected requirements and aircraft mission are additional considerations for selection.
>
> The HI-PRI plan also provides for the special identification of the items selected, through the medium of a "Q" Fraction in the stock number and the identification of all other repairables by the use of an "H" Fraction code. The HI-PRI program is accomplished through special procedures and techniques instituted to provide for minimum procurement and rapid turn around of HI-PRI items throughout the logistic cycle. HI-PRI procedures affect and are applicable to all functional areas. Strict control, accurate reporting and good management of assets must be enforced throughout the life of the HI-PRI item to assure the success of the plan.[37]

The HI-PRI plan also accelerated the reporting cycle on all other repairable assemblies as follows:

> The Aviation Supply Office in the interest of reducing turn around time of all repairable assemblies considers more frequent inventory reporting to be an

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[37] U. S. Navy Department, Aviation Supply Office, HI-PRI Plan and Related Inventory Control Refinements Information and Procedures Concerning, ASO Field Instruction 4408.1A dated 20 April 1959, Encl. 1, p. 1.

essential requisite, providing for more timely redistribution, procurement reviews, and overhaul scheduling of this category of material in order to permit the most efficient use of these assets and to minimize procurement and interim requisitioning. All repairable assemblies, except those included in the HI-PRI program, are at present assigned the Fraction Code "H" for the purpose of special inventory controls. In order to attain the above objectives, the ASO has established Monthly Stock Status Reporting for these assemblies.[38]

Operating procedures under the plan are divided into three groups:

1. Inventory control procedures governing HI-PRI ("Q" fraction) items and "H" fraction repairable assemblies.[39]

2. Procedures governing the "VIM" list, the monthly inventory report of Very Important Material in critical supply.[40]

3. Procedures governing the monthly stock status report on certain Buaer-controlled ("V" cognizance) material.[41]

Though the HI-PRI plan is of major importance in control of the equipment inventory, the number of items subject to the plan is surprisingly small. Of over 400,000 items in the inventory, the "Q" fraction initially covered only 700. Coverage has now been extended to 1521 items and "full" coverage of 2200 items is expected by July 1959.[42] The "H" fraction numbers about 26,000 items, so that at full coverage and a total of 28,000 items, the plan will involve only about

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[38] Ibid.

[39] Ibid., Encl. 1.

[40] Ibid., Encl. 2.

[41] Ibid., Encl. 3.

[42] Ibid., Encl. 1, p. 1.

6 percent of the items in the equipment inventory. Cost-wise, of course, the story will be quite different.

Reporting channels are as direct as possible. Continental reporting points submit HI-PRI requisitions direct to ASO. Primary stock points screen their own area prior to submission. Overseas points submit requirements to NSC, Norfolk or NSC, Oakland, as applicable. Master Jet Stations also submit requests direct to ASO.

In order to avoid duplication, the items of the "Q" and "H" fractions are removed from the QSSR system and no Consolidated Stock Status Report is distributed on them, since ASO takes direct action on all requests. Redistribution action for the overseas areas is taken by the appropriate controlling supply center.

Stock status reports on items under this plan give replenishment demand for the past month, thus shortening the QSSR cycle to one-third. Because of the short reporting cycle, only "Emergency" and "Scheduled" priority requirements are submitted. "Routine" priority requirements are considered to be served automatically by the status reports. Tailored decks of EAM cards are furnished to all activities monthly by ASO for all "H" fraction and Buaer-controlled items. No cards are required for the "Q" fraction material, since active item reports are made to ASO daily on these items by all continental primary and secondary reporting points via teletype. Overseas secondary stock points report weekly by air mail. VIM lists are also furnished by ASO monthly. Monthly reports of on-hand

balances are made by all reporting activities except certain aviation vessels and Fleet Marine Force aviation units which report quarterly.

Reporting of active items of the "H" fraction by primary and secondary stock points is on a monthly basis.

ASO prepares monthly "Q" and "H" fraction consolidated stock reports for redistribution purposes, but only the area lists are circulated to the field, and these are limited to the two supply centers controlling overseas areas.

To expedite transactions under the plan, special marking of all documents with the word "HI-PRI" is required. A special symbol, as shown in Figure 4, is provided for all packages and crates. In addition, time limits for processing HI-PRI requirements are set at four working hours for "Emergency" requests and eight working hours for "Scheduled" requests. Routine requirements must be processed in twelve working hours.[43] Similar time limits are set for "H" fraction material, but no special markings are authorized.

Field activities are expected to use special facilities and techniques, as follows, to expedite material deliveries under this plan, if required.

1. Special Overhaul and Repair Department production lines.

2. Segregated storage.

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[43] U. S. Navy Department, Bureau of Supplies and Accounts, Bureau of Supplies and Accounts Manual, Vol. II, Paras. 26006-3, 26061-2.

Fig. 4.--HI-PRI Plan, Shipping Symbol

3. Special receiving bags.

4. Special screening units.

5. Special inventory teams/stock batteries.

To insure reporting all material on hand, supply activities are required to:

1. Convert retail outlets to the auxiliary store method of operation or

2. Disestablish retail outlets and return material to central supply.

Special provisions are made for expediting turn-in of repairables.[44]

Transportation deadlines for "Q" and "H" fraction material are set at not more than seven days for "Routine" moves between continental activities and twenty-four days between overseas destinations or between U. S. and overseas destinations. Mode of transportation for "Emergency" and "Scheduled" shipments is determined by urgency. Holding for consolidation is not permitted unless time can be saved thereby. Packaging separate from non-HI-PRI items is required.

Physical inventory of all HI-PRI plan items is taken quarterly. Activities are enjoined to use picked men and special care in the process.[45]

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[44] ASO Field Instr. 4408.1A, _op. cit._, Encl. 1, p. 10.

[45] _Ibid._

A special reporting booklet called the Very Important Material ("VIM") List is used to provide for monthly HI-PRI reporting from other than primary and reporting secondary stock points and to permit primary and secondary stock points to report non-repairable critical items. This booklet is divided into three parts:

Part I. Lists all "Q" fraction items. Critical items are flagged.

Part II. Lists all critical repairable assemblies, excluding critical "Q" fraction items.

Part III. Lists all critical non-repairable items.

Monthly reports of on-hand balance are submitted to ASO by reporting activities on Part III which does not duplicate the HI-PRI reporting plan. Non-reporting activities, except aviation vessels and Fleet Marine Force aviation units report all parts monthly. Vessels and marine units report quarterly. ASO compiles consolidated VIM lists for internal use and regional VIM lists for use by NSC, Norfolk and NSC, Oakland.

Monthly reports of all Buaer-controlled items listed in SNDS S1088 of the Navy Stock List are submitted by reporting activities. Tailored reporting decks of EAM cards are provided for non-mechanized activities. Aircraft engines are now included in this list. ASO prepares a consolidated monthly report of this material for Buaer control use.

Project SAM. This project is one of the auxiliary inventory reporting systems used by ASO to facilitate inventory

management of special categories of material, in this case any material causing an aircraft to be out of commission for parts (AOCP). The system began as a three month experiment in the Pacific Fleet, during which use of Project SAM reporting procedures reduced the number of out-of-commission aircraft by an average of sixty per day.[46]

The procedure consists of daily screening by ASO of AOCP material via the teletype network. Screening is accomplished by requiring continental activities on the network to transmit all unfilled AOCP requisitions to ASO daily at 2100 EST. By 2300 EST, ASO transmits a consolidated deck of AOCP cards to all field activities. Field activities report the local results of this action by 1000 EST the next working day, which for this particular AOCP list, is hereafter designated as "SAM" day. Acting on the field reports, ASO then directs redistribution of AOCP material as required, completing East Coast activities by 1200 EST and West Coast activities by 1400 EST.

For items not located in the original screening process, a "residual" screening message is sent to all field activities by ASO on "SAM + 1" day requiring a physical check of stocks for the deficient items. Reports of this recheck are due at ASO by 1200 EST on "SAM + 2", by teletype or 1600 EST by priority message. The Bureau of Aeronautics Maintenance

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[46] U. S. Navy Department, Aviation Supply Office, Screening for AOCP Material, ASO Field Instruction 4235.18 dated 5 December 1958, p. 1.

Representatives (BAMRS) check the Overhaul and Repair bases in their areas and report to ASO on "SAM + 3" deficient items available for processing. The BAMRS further report to ASO on "SAM + 4" as to estimated completion dates for processing items needed in each BAMR area. ASO sends cancellation messages out as each item is delivered to keep daily lists current.

SAM coordinators are appointed at all field activities. All documents referring to AOCP transactions bear a "SAM-day" and residual item number. Follow-up begins, if required, on "SAM + 2".

Project SAM has been in effect since 15 December 1958. Preliminary reports indicate that it is making a significant reduction in AOCP time.

Selected Item Reports. The Selected Item system involves procedures for an annual physical inventory of capital equipment. Capital equipment is defined as ASO-controlled material having a unit cost of $100 or more and having accounting codes "O", "A", or "E", which indicate material durable in nature and used by aviation activities for overhaul, maintenance, or test of aircraft or engines and not generally used in actual flight operations.[47]

This system was set up to cover equipment which does not lend itself to the RDIS system based on past demand, nor

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[47] U. S. Navy Department, Aviation Supply Office, Reporting System for Selected Items of Aviation Equipment, ASO Field Instruction 4440.64 dated 24 Oct. 1957, p. 1.

to the PURS system based on future operations. The information is needed for Congressional inquiries, budget formulation, etc. Separate inventory management reports on this type of material are required to insure:

1. Proper justification for budgeting and procurement.

2. Adequate and timely support of Fleet operations, Training Command programs, etc.[48]

Total Asset Control Reports. This auxiliary reporting system provides for semi-annual reports of installed and spare assemblies on-hand. A special list of 108 critical items, mostly electronic, is involved and a special reporting form (DD Form 764) is used. The system was devised to provide comprehensive asset information for Material Planning Studies and for the purposes noted in the Selected Item Report system above.[49]

The Transceiver Network. The transceiver network of the Aeronautical Logistics System is centered at ASO, Philadelphia. The network is divided into three "lines" as shown on Figure 5. The Eastern Line serves:

NASD, Philadelphia, Pa.

NAS, Quonset Point, R. I.

NAS, Lakehurst, N. J.

NAS, Norfolk, Va.

NSD, Norfolk, Va.

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[48] *Ibid.*, p. 2.

[49] U. S. Navy Department, Aviation Supply Office, Total Asset Control; Report of Installed and Spare Equipment, ASO Field Instruction 4440.59A dated 10 March 1958, pp. 1-2.

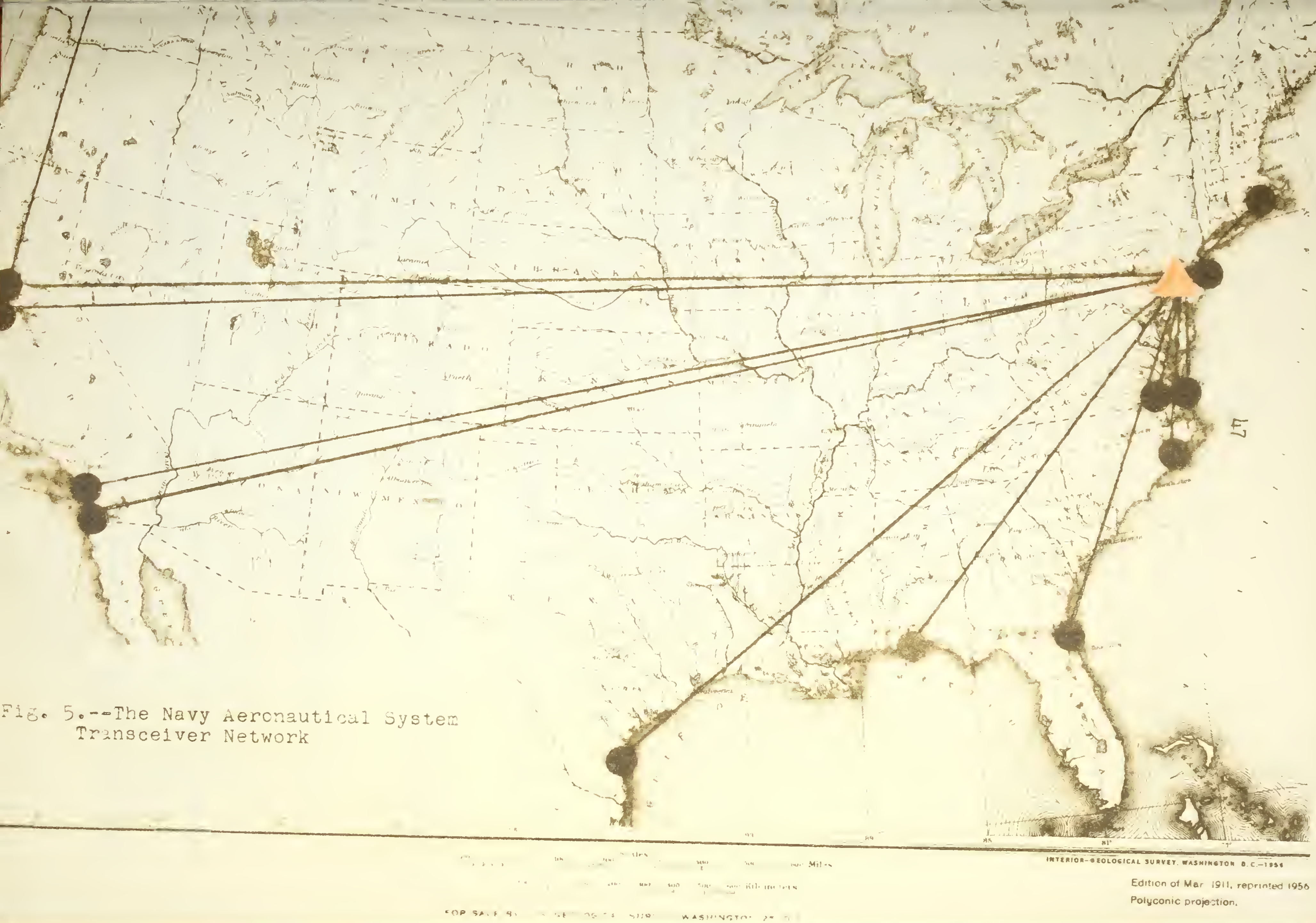

Fig. 5.--The Navy Aeronautical System Transceiver Network

The Southern Line serves:

MCAS, Cherry Point, N. C.

NAS, Jacksonville, Fla.

NAS, Pensacola, Fla.

NAS, Corpus Christi, Tex.

The Western Line serves:

NAS, Whidbey Island, Wash.

NAS, Alameda, Calif.

NSD, Oakland, Calif.

MCAS, El Toro, Calif.

NAS, North Island, California

Each station, except NAS Whidbey Island, has a direct line to ASO, which acts as relay for the system. The general sequence plan for transmitting and receiving is as follows:

1. Field activities transmit interim requisition cards.

2. ASO transmits completed redistribution cards on the above.

3. ASO relays incomplete interim requisition cards.

4. ASO transmits status, interrogation, follow-up, replies, and message cards.

5. Field activities transmit status, etc.

6. ASO relays status, etc.

At 1700 GMT Monday through Friday, Field Activities transmit "Emergency" requisitions to ASO. ASO then relays as required. "Scheduled" and "Routine" transmissions start at 2200 GMT. Accumulated "Emergency" messages are also transmitted at this

time. Voice may be used when the network is not in scheduled use. Certain types of requisitions are not yet adapted to the card transceiver system due to requirement for written justification, etc.[50]

Overseas communications are conducted via air mail or through the Navy's world-wide radio network as required.

Usage of the transceiver network is expanding rapidly and several special reports have been authorized for transmission, some on a trial basis. For example:

1. Aeronautical Overhaul Work Stoppage Reports (AOWS) and RB/RE and EB/EE Critical Item Overhaul Status Reports.[51]

2. A Special Financial Inventory Control Report is transmitted on the last day of the month. Control ledger balance totals for all captions on the Financial Control Report (BuSandA 4443-1) are included.[52]

3. Usage data is reported by major overhaul points

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[50] U. S. Navy Department, Aviation Supply Office, Naval Aeronautical Supply Transceiver Network, Instructions for ASO Field Instruction 4235.3A dated 15 March 1957.

[51] U. S. Navy Department, Aviation Supply Office, Aeronautical Overhaul Work Stoppage (AOWS) Reports and "RB/RE" and "EB/EE" Critical Item Overhaul Status Reports; Procedures for Compilation, Maintenance, and Submission of, ASO Field Instruction 4710.15D dated 26 Dec. 1957.

[52] U. S. Navy Department, Aviation Supply Office, Special Financial Inventory Control Report, ASO Field Instruction 4443.1B dated 9 Oct. 1958.

via the transceiver network. This is considered an interim procedure while the problem of usage data collection is being readied for EPDM application. The first test period for this report was 16 May to 15 November 1958.[53]

4. A trial use of the network for submission of NSC, Pearl Harbor and Pearl Harbor Naval Shipyard requisitions for General Stores material has been authorized.[54]

Summary. The organizational elements of the Navy's aeronautical Logistics System have been reviewed. The size and nature of the system inventory have been described. Inventory management methods for the engine and equipment inventories have been outlined, and the system stock status reports have been listed. The foregoing bounds the system as it has evolved in the last five years and as it exists for the "moment". Since little is or can be static in the changing military world of today, major modifications to the system are already in process. Some of these will be considered in the next chapter.

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[53] U. S. Navy Department, Aviation Supply Office, Reporting of Overhaul Usage Data via Transceiver Network; Instructions Covering, ASO Field Instruction 4710.1 (undated).

[54] U. S. Navy Department, Aviation Supply Office, Trial Utilization of Transceiver (TXR) Network for the Submission of NSC, Pearl Harbor and Pearl Harbor Naval Shipyard Interim Requisitions for General Stores Material. ASO/GSSO Joint Field Instruction 4235.1 dated 13 Oct. 1958.

CHAPTER III

THE REFINED AERONAUTICAL SUPPORT PROGRAM--
PROJECT RASP

Background and Aims.--The Refined Aeronautical Support Program, Project RASP, is a joint Buaer/BuSandA project with the objective of achieving, "the maximum capability of modern aeronautical weapons systems with minimized logistic cost."[55] This project, which was initiated in a directive signed jointly by the chiefs of Buaer and BuSandA on 16 February 1959, is the outward manifestation of evolutionary stresses that have been mounting for some time within the aeronautical logistics system. These pressures have the following primary sources:

1. The growing realization in all areas of the Defense Establishment of the need for management improvements.

2. The increasing budgetary restrictions.

3. The increasing cost and complexity of weapons systems.

Improvements in electronic computers and the growing confidence of key management personnel in electronic data processing techniques have served as the necessary catalysts.

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[55]NAVAER 00.108, op. cit., p. 1.

Acknowledgement of this fact comes in the second sentence of the basic project directive which states, "Implicit to the success of this program is the timely installation of high-speed data computation and transmission systems."[56]

The program is directed at two broad management areas, namely: inventory management and workload control. Effort is to be applied toward:

a. Improvement of existing techniques.
b. Institution of new methods and techniques.
c. Increased logistic self-sufficiency in major fleet support complexes.
d. Increased self-sufficiency and provision of more timely readiness and logistic information for Fleet Type Commanders.
e. Provision of more timely and accurate logistics and readiness data to headquarters.
f. Management of material assets by weapons system category, value and repairability.
g. Reorganization as required within the bureaus and their field activities.[57]

The program includes immediate establishment of joint Buaer/BuSandA working committees and submission of semi-annual progress reports to the bureau chiefs commencing 30 June 1959.[58]

The problem to which Project RASP is addressed has been summarized as:

> To maintain weapon systems force levels while the cost of input per unit rises and the inventory of weapons systems and W/S support material declines.[59]

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[56] Ibid.

[57] Ibid., pp. 1-2.

[58] Ibid., p. 2.

[59] Ibid., Encl. 1, p. 2.

A three-fold solution is proposed through:

1. Less out of service time for lack of material support to the Fleet.
2. Less out of service time for maintenance and rework.
3. Increased quality of readiness and safety.[60]

As noted previously, these solutions fall in the inventory management and workload control areas of the Aeronautical Logistics System.

Accomplishments to Date.--Since Project RASP is but one step in an evolutionary process, all that has preceded it might in a sense be classed as "prologue." Certain recent modifications of the system, however, show their kinship most clearly and may be justly regarded as precursors of this project. These modifications include:

1. The clarification of authority and responsibility for material management which has resulted from the transfer of management control of ASO from Buaer to BuSandA. This final step in the incorporation of ASO into the Integrated Supply System was announced by the Secretary of the Navy on 6 March 1959.[61]

2. The HI-PRI program detailed in Chapter II.

3. The Transceiver network also described in Chapter II.

4. Project SAM covering AOCP material.

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[60] Ibid., Encl. 1, p. 6.

[61] U. S. Navy Department, Office of the Secretary of the Navy, Aviation Supply Office; Reassignment of Management Control of, SECNAV Notice 5450 dated 6 March 1959.

5. The growing use of EAM by field activities, including the mechanization of auxiliary stores at all industrial air stations.

6. The increased diversity of O & R rework capacity through the "Customers Service" program, for which $8 million has been programmed in Fiscal Year 1960.[62]

Areas for Improvement.--The benefits desired from this project fall into two categories, a) those that can result from improvement of existing techniques, and b) those that can result from introduction of new techniques. In the first category, we might include improvement of asset knowledge at all levels in the organization and extension of the rapid communication/auxiliary store program within major fleet complexes and between major fleet complexes. New techniques might include provision locally of means and procedures for rapid computation of capability to meet logistic requirements. This obviously involves computer installations in the field. Such installations would also permit daily status or perhaps transaction reporting on aircraft engines and critical high-cost items.

Increased self-sufficiency in major fleet support complexes is a necessity under nuclear age conditions. Project RASP recognizes this by planning increased decentralization of logistic authority and increased logistic capability of field

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[62] U. S. Navy Department, Bureau of Aeronautics, CUSTOMER SERVICES--Overhaul and Repair Departments; Policy of, and Procedures for Obtaining, Buaer Instruction NAVAER 00.110 dated 19 March 1959.

activities. Formation of Naval Air Material Areas (NAMA) is planned. These areas, which will be described below, will be provided with centralized data collection capability.

Decentralization.--The Aeronautical Logistics System as now constituted is controlled centrally by ASC and Buaer to a degree undesirable if not unsafe from the readiness standpoint. This fact was recognized some time ago by the controlling authorities and a gradual expansion of field capability was undertaken. Mechanization of the auxiliary stores at industrial air stations and the assignment of overhaul cognizance on out-of-production aircraft to the industrial air stations are examples of this trend. Project RASP includes large additional increases in field capabilities for logistic control. The first step is to be formation of Naval Air Material Regions (NAMR) and Naval Air Material Areas (NAMA) to replace the present arrangement under which limited authority for work load adjustment at the overhaul and repair bases is exercised by four Bureau of Aeronautics' Maintenance Representatives (BAMRs), one on the East Coast at Norfolk, one on the Gulf Coast at Pensacola, one on the West Coast at North Island, San Diego, and one in Hawaii.

The new plan will divide the country into three material regions, East, Central, and West. Each region will serve a major fleet complex and be headed by a Bureau of Aeronautics Maintenance and Support Representative (BAMSR) with responsibilities and capabilities greatly increased over those of the present BAMR's. The core of the BAMSR's increased

capability will be electronic data processing facilities. The proposed organization is shown in Figure 6. Headquarters for the western region for example will be NAS, North Island, San Diego, permitting the BAMSR's EDP requirements to be combined with those of NAMA, North Island and the air station. The NAMA headquarters will be one of the large industrial air stations, to which EDP installations will be added. These activities are already equipped with EAM installations tied in to the aeronautical system transceiver network. The Supply Officer of the industrial air station will also be designated as NAMA supply coordinator. He will in this capacity, maintain current inventory status data on all other naval aviation activities in his area. This centralized inventory together with data from the local Overhaul and Repair base will enable the NAMA to furnish the BAMSR with prompt and complete logistic information for his entire area, including computed completion dates for material in overhaul. The BAMSR will thus be able to utilize fully the combined inventory and work-in-process potential of all activities in his region to meet fleet needs.

Inventory Reclassification.--The inventory categories noted in Chapter II in the discussion of the HI-PRI plan are refined and extended under Project RASP "to reduce cost and increase over-all control effectiveness."[63]

In describing the HI-PRI plan, it was stated that repairables numbered 28,000 items or about 6% of the aeronautical equipment inventory. Project RASP planning studies showed

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[63] NAVAER 00.108, Encl. 1, p. 26.

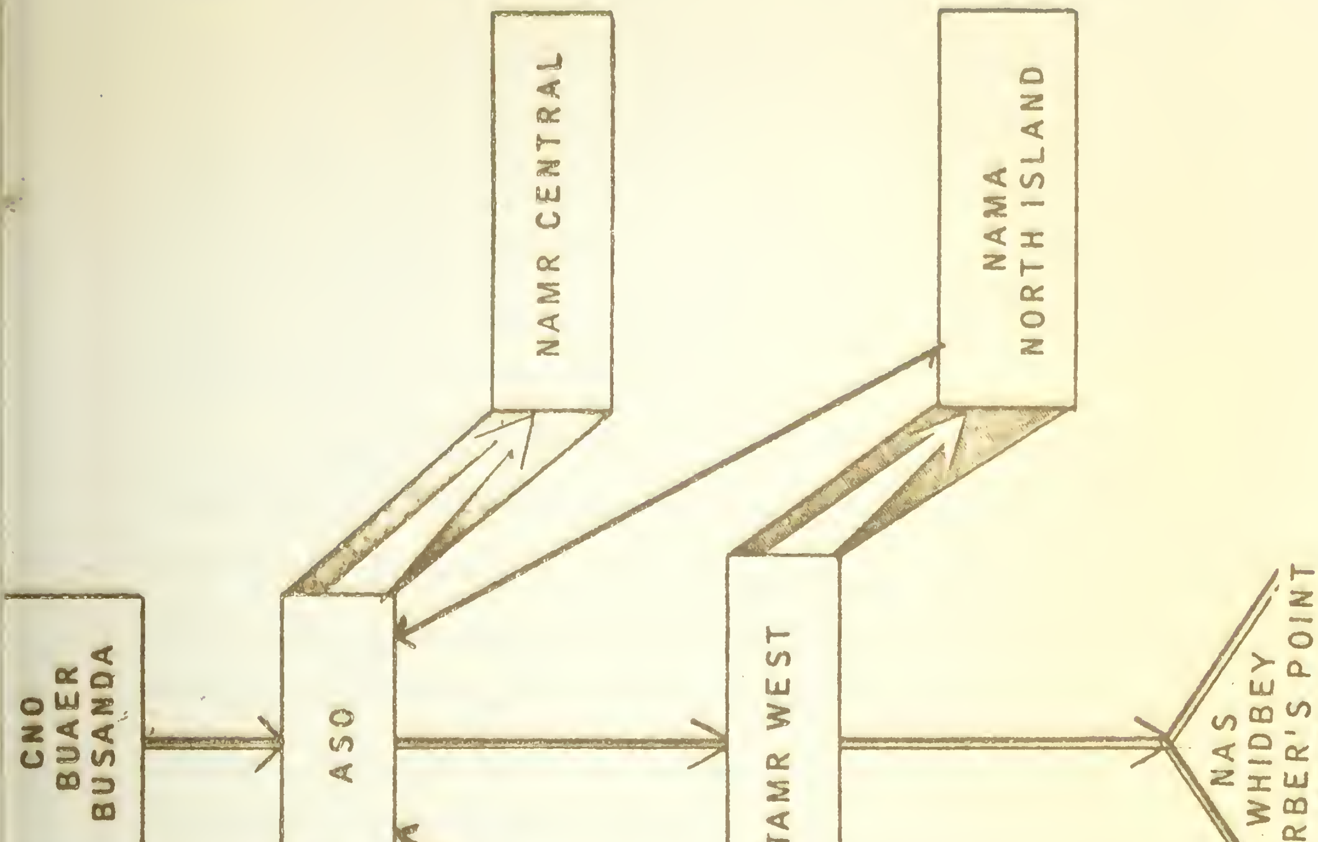

Fig. 6.--Proposed Naval Aeronautical Material Organization--Project RASP

further that of the repairable items only 3,500 cost over $5000 each and that only 500 of these are subject to flight hour limits. The studies also showed that the high cost units, which item-wise constitute less than 1% of the inventory, account dollarwise for over 35% of the inventory.[64] To put the analysis in other terms, if full control is attained of the less than 1% of the items that cost over $5,000, full control will be gained thereby of more than one-third of the dollar-value of the inventory.

In developing the above idea, Project RASP planners reclassified the aeronautical equipment into five groups on the basis of cost and repairability. As shown in Table 3, each group was assigned an appropriate gem-stone code name ranging from "Diamond" for high cost flight limited items to "Garnet" for low cost non-repairable items. Identification, control, and reporting procedures for each group are made commensurate with value. Reporting, for example, ranges from daily for active items in the Diamond group to annually for items of the Garnet group.

The Computer Program.--As noted previously, timely installation of high speed electronic data processing and transmitting equipment is "implicit to the success of this program." Project RASP plans call for seven EDP centers at industrial air stations. Three of these centers, as shown in

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[64] W. B. Kirkland, Cdr., USN, "The Refined Aeronautical Support Program--Project RASP." Presentation to Computer Manufacturers, Buaer, Washington, D. C., Feb. 19, 1959.

TABLE 3

GROUPING OF MATERIAL IN THE AERONAUTICAL EQUIPMENT INVENTORY UNDER PROJECT RASP

Item Type/Value	Controls/Group Name
1. Hi Value Repairable Flight Hour Limit	Ident. by Serial No. Full Cycle Control Daily Active Item Reporting Actuarial Analysis
$5,000 + each	DIAMONDS
2. Hi Value Repairable	Ident. by Serial No. Full Cycle Control Daily Active Item Reporting
$5,000 + each	EMERALDS
3. Mid-Value Repairable	Ident. by Stock No. Full Cycle Control Monthly Active Item Reporting
$5,000 + each	RUBIES
4. Hi-Value Non-Repairable	Ident. by Stock No. 1/2 Cycle Control Quarterly Report
$10 + each	AMETHYSTS
5. Lo-Value Non-Repairable	Ident. by Stock No. 1/2 Cycle Control Annual Report
$10 each	GARNETS

AERONAUTICAL MATERIAL INVENTORY

460,000 Line Items
of these;
28,000 Repairable
and of these;
3,500 cost over $5,000 each
and
500 have a flight-hour limit.

Table 4 below will have additional capacity for fleet command requirements also.

TABLE 4

AERONAUTICAL LOGISTICS SYSTEM ELECTRONIC DATA PROCESSING CENTERS UNDER PROJECT RASP

Activity	Serving	Computers
NAS, Alameda, Cal.	NAMA, Alameda	Single, large
NAS, Norfolk, Va.	COMNAVAIRLANT BAMSR East NAMA, Norfolk	Multiple, large
NAS, North Island, Calif.	COMNAVAIRPAC BAMSR, West NAMA, North Island	Multiple, large
NAS, Jacksonville	NAMA, Jacksonville	Single, large
NAS, Pensacola, Fla.	CNATRA BAMSR, Central NAMA, Pensacola	Single, large
NAS, Quonset Pt., R. I.	NAMA, Quonset Pt.	Single, medium large
MCAS, Cherry Pt., N. C.	NAMA, Cherry Pt.	Single, medium large

Intermediate data processing capability including random access will be provided at thirteen other points, as follows:

NAS, Moffet Field, Cal.	NAS, Key West, Fla.
NAS, Miramar, Cal.	NAS, Brunswick, Me.
NAS, Cecil Field, Fla.	NAS, Whidbey Island, Wash.
NAS, Oceana, Va.	MCAS, El Toro, Cal.
NATC, Patuxent River, Md.	NAMC, Philadelphia, Pa.
NAS, Corpus Christi	NAS, Point Mugu, Cal.

NAS, Lakehurst, N. J.

Mechanized capability including card punching, sorting, and reading equipment will be provided at the balance of naval aviation activities.

The EDP described above will be rented rather than purchased. Annual cost estimates are given in Table 5 below:

TABLE 5

ESTIMATED ANNUAL COST EDP EQUIPMENT--
PROJECT RASP[65]

Equipment	Estimated Annual Cost
Total of the 7 large centers	$3,500,000
Total of 13 intermediate centers	$3,000,000
Mechanized equipment at balance of activities	$1,000,000
Expansion of transceiver network	$ 800,000
Total EDP facilities, Project RASP	$10,000,000

In describing the proposed program to representatives of all the large computer companies in a meeting in the Bureau of Aeronautics on 19 February 1959, Navy spokesman explained that while all makes of computers would be considered for the program, the transceiver portion of the installation must be able to send and receive from standard IBM-type eighty column cards in order to permit integration with the existing network. It was also explained that, since tape to tape capabilities would be needed in some cases, some form of tape-to-tape converter might also be required.[66]

[65] Ibid.

[66] Ibid.

The necessary data processing units will be organized and integrated into the major stations as shown in Figure 7.

Present schedules require completion of the first large EDP center at North Island by the middle of fiscal year 1961, with the other two large installations following at one per year. Completion of the entire program is scheduled by the end of fiscal year 1965.

Summary of Expectations.--The bureau sponsors of Project RASP hope and expect that it will provide the following:

1. Management of bureau controlled assets with up-to-date factual asset knowledge under centrally directed procedures.

2. Total asset control to meet requirements of military necessity and economical management.

3. Better capability for fleet commanders to make sound operational commitments based on realistic logistics data.

4. Better utilization of industrial potential.

5. Increased O & R response to meet changing rework requirements.

6. Ability to forecast trouble areas in any phase of the weapon cycle.

7. Minimum stock levels, permitting some one-time savings in inventory and continuing savings in annual recurring costs.

8. More timely disposal action.

9. Realistic computation of mobilization reserve requirements.[67]

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[67] NAVAEROO.108, op. cit., Encl. 1, pp. 40-41.

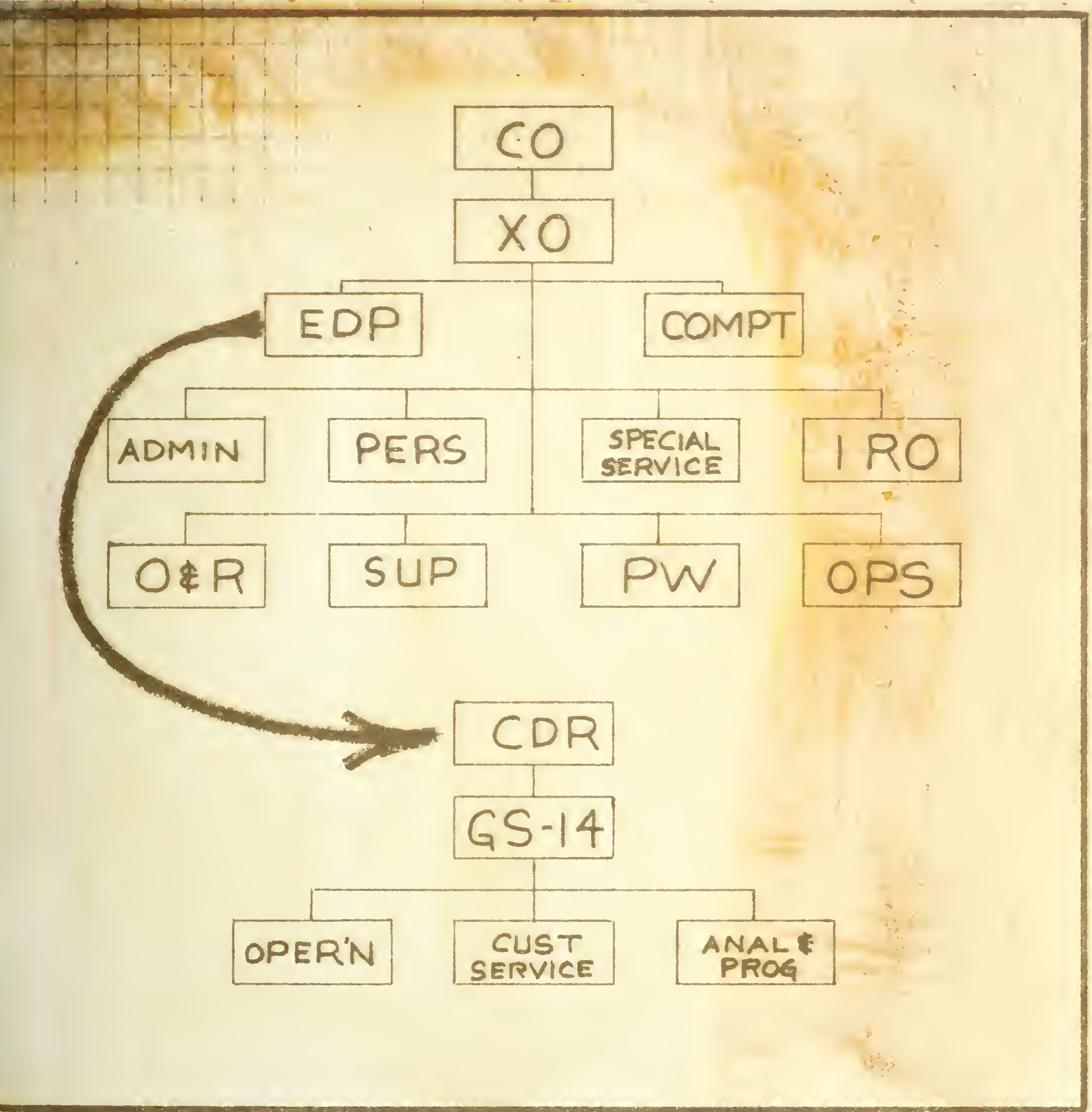

Fig. 7.--Field Activity, Electronic Data Processing Center Organization

Further, it is expected that overall aeronautical program costs will not increase. Potential savings areas are considered to be:

1. Initial procurement of support material.
2. Replenishment procurement.
3. Annual recurring costs in supply operations and transportation.[68]

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[68] *Ibid.*, p. 42.

CHAPTER IV

FUTURE DEVELOPMENTS

General.--Future developments in the Aeronautical Logistics System will, of course, be the resultant of many complex factors. Two of the most important--and conflicting--are the downward trend of the aircraft inventory and the upward trend of cost and equipment complexity. These trends are illustrated in the following tables:

TABLE 6

TOTAL AIRCRAFT INVENTORY, NAVY AND AIR FORCE[69]

Fiscal Year	NAVY Percent 1958 Total	NAVY Total Aircraft	USAF Percent 1958 Total	USAF Total Aircraft
1957	--	11,617	--	--
1958	100.0%	10,654	100.0%	22,000
1959	89.2%	9,500	94.5%	20,800
1960	85.5%	9,100	90.8%	19,982

[69] Aviation Week, op. cit., Mar. 9, 1959, pp. 73 and 81.

TABLE 7

INCREASE IN COMPLEXITY OF NAVAL AERONAUTICAL MATERIAL, 1954-1960[70]

Item	Increase Factor
Electronics	X 10
No. Repairable Items	X 7
A/C Fuel Consumption	X 4
Material Items/A/C	X 4
Total Cost	72%

TABLE 8

INCREASE IN MAINTENANCE REQUIREMENTS OF NAVAL AIRCRAFT, 1945-1959[71]

Year	Average Maintenance Man Hrs/Flt Hr.
1945	VF - 10
1951	VF - 18
1959	VF - 40
	VA - 80

[70] Presentation, Reynolds & Kirkland, *op. cit.*

[71] *Ibid.*

Table 6 above demonstrates that aircraft inventories are shrinking rapidly, ten percent for the Air Force and fifteen percent for the Navy since 1958. Though no information has yet been released on inventory plans for 1961, it seems likely that the downward trend will continue. The implications of this trend for the future of the Aeronautical Logistics System are crystal clear--as long as no other factors are taken into account. The steep increases in complexity and required maintenance effort shown in Tables 7 and 8 have implications which are probably equal and certainly opposite to those of Table 6. What are we to think? Which way will it go and how far? Obviously the planners of Project RASP feel that aeronautical logistic problems will increase rather than decrease in the 1960's at least. Tables 7 and 8 show the basis of their reasoning, in part. Additional considerations favoring this view which are not shown in the tables include:

1. Probable increased requirements in ASW aircraft as a counter to the rapidly increasing numbers and capabilities of Russian submarines.

2. Probable increases in the application of aircraft to naval problems as a result of helicopter improvements and the development of new aircraft types which can hover and fly vertically.

3. Increased requirement for dispersion of inventory to minimize losses from nuclear attack.

Development of the EDP program will continue. Project RASP is, obviously, but a step toward a completely integrated

aeronautical EDP system which will include ships. The recent successful test of a completely mechanized supply ship (ALTAIR) is a case in point. Extension of the program to overseas bases is a probable near-future development also. Operational research techniques and general EDP experience will doubtless produce procedural changes which are beyond our imagination at present due to a lingering "taint" of our heritage from punch card days.

Certain serious pitfalls will yawn as inventory management improves. Early and prompt detection and elimination of surpluses is a laudable aim which has received ample publicity. The other side of the surplus coin is rarely shown. Who, for example, knows how much money and time has been saved by not throwing away a "surplus" when changing circumstances altered its classification abruptly after contracts were cancelled and jigs broken up? Navy planners and fleet maintenance men have had many occasions to bless failures in the disposal program. Careful precautions must be devised to insure that improved controls do not result in elimination of spares before the supported weapons system is actually not theoretically retired. Another problem of improved inventory management is the increased dependence of the system on long range communications and centralized decisions. Unless great care is taken in organizing around these vulnerable points, a fine system may result; suitable only for use in peace time when the sun-spots are inactive.

Computer systems are proliferating. Except for the

punch card link (slow speed) these systems are not compatable and can communicate only through complex, expensive, and custom-built converters. A 1957 survey showed four manufacturers supplying EDP machines to the Services.[72] Two years later at least seven manufacturers are interested in supplying equipment for Project RASP,[73] and at least thirty-two companies are now in the aviation-military computer market.[74] In self defense, the Services will have to force some standardization. "How much and how soon?" are questions with numberless economic, political, and technical ramifications. No immediate answers seem in prospect.

Conclusions.--It is concluded that:

Though aircraft weapons systems are decreasing in number and relative importance as a result of the introduction of new weapons systems, the problems of the Aeronautical Logistics System will not decrease in proportion. In fact, it is probable that complexity increases and other factors will actually result in somewhat greater problems for this logistic system in the future than in the past.

The problem of dispersing inventory to minimize destruction by nuclear attack will increase the difficulties of

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[72] Earle B. Butler, Lt. Col. USA, "The Use and Potential of Electronic Computers in Developing Military Material Requirements." (Unpublished thesis, Industrial College of the Armed Forces, 1957), pp. 65-75.

[73] W. B. Kirkland, Cdr., USN, op.cit.

[74] Philip J. Klass, "Survey Shows Size of Computer Market," Aviation Week, Feb. 16, 1959, p. 77.

inventory management in the future.

Shipboard EDP installations have been proved feasible. The use of this technique will increase.

Present plans call for increased use of commercial overhaul for Navy aircraft. This trend will introduce additional problems for the logistic system due to procedural differences, inventory dispersal, etc.

As the number of different EDP installations increase, problems of system integration will arise unless standardization of inter-system communication is accomplished. The difficult economic, political, and technical aspects of this question make early standardization unlikely.

The trend toward increased integration and mechanization of logistic systems while promising great benefits also produces increased dependence on rapid long range communications. This dependence in turn increases vulnerability of the system in wartime.

The latest plan for refinement of the Aeronautical Logistics System, Project RASP, is a logical evolutionary step toward complete integration and mechanization of the system. Further steps will probably include extension of the communication network and mechanization to include both overseas stations and supply ships at sea. While the present congestion of operational communication channels is recognized, it is believed that "room" will have to be made for logistic channels if the fleets future support needs are to be met.

The use of EDP machines for logistic purposes is increasing more rapidly in the Navy than is generally realized. In the two month period from March 7th to May 9th, 1959, for example, the Navy Times carried announcements of new EDP installations at NSSO Brooklyn, New York, MCSC, Albany, Georgia and NOSO, Mechanicsburg, Pa. An installation was also completed recently at ESO, Great Lakes, Ill. Interviews with personnel at all but the highest levels of the aeronautical logistics system indicate that the implications and potentials of EDP are not widely or fully appreciated.

The improvements in the Aeronautical Logistics system resulting from EDP techniques will take the form of improved services rather than personnel decreases. New capabilities will probably generate new demands.

Recommendations.--It is recommended that:

1. The problems of logistic support arising from dispersal of inventory against nuclear attack be given more consideration in logistic planning.

2. Efforts be made to increase the appreciation of personnel at all levels of the implications and potentials of EDP techniques.

3. Future plans for increasing integration of the Aeronautical Logistic System include greater consideration of the vulnerability of the system to communication interruptions in proportion to the increased dependence of the system on such communications.

4. The possibility be kept in mind that restrictions on

the availability of highly-skilled personnel may limit mechanization of the system even more than cost.

5. The procedures of the system be kept under continuous review due not only to the highly fluid technical situation but also to the probability that potential improvements possible with EDP have barely been scratched at this early stage in our experience.

6. Consideration be given to devising automatic program balance balance cross checks for the EDP system so that old programs can't get out of balance without warning and new ones can't start without proper balance in all phases or at least without warning from the computer that the balance check-off list was not complete.

7. Consideration be given to furnishing the field with certain technical information as well as catalogs on tape so that frequent updating by EDPM would be possible.

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